

Human Computer Interaction

CS449 – CS549

Introduction: What is HCI and why is it important?

KÜRSAT ÇAĞILTAY

WEEKLY PROGRAM – (Tentative)

1. Introduction: What is HCI and why is it important?
2. From interface to interaction: HCI Theories, frameworks
3. What is a good user interface: Guidelines, Styles, and Evidence
4. Usability engineering
5. Beyond usability engineering: Understanding the user (part 1) Human Cognition
6. Beyond usability engineering: Understanding the user (part 2) Perception
7. Evaluation strategies for usable interface design: Heuristic Evaluation and Cognitive Walkthrough
8. Evaluation strategies for usable interface design: User based testing & eye tracking
9. Evaluation strategies for usable interface design: Cognitive Modeling
10. HCI Research Methods: Quantitative and qualitative
11. UI Prototyping & Wireframes, Personas, Use Scenarios, and Storyboards
12. Software engineering methodologies and User-Centered Design
13. Accessibility, Interaction and cutting-edge technologies: XR, BCI, HRI
14. HCI and Ethics in the design of information systems for users

Assignments And Grades (Tentative)

- Assignment-1 Design diary report (with redesign – Figma) = 5 pts
- Assignment-2 Laws of HCI (Fitt's Law) = 5 pts
- Assignment-3 Cognitive Modeling Assignment = 10 pts (This assignment requires CogTool cognitive modeling software, make sure it works on your own computer: <https://www.cogtool.org/>)
- Assignment-4 Heuristics Based Usability testing = 13 pts
- Assignment-5 Development of a Gesture-based interaction using Mediapipe = 10pts
- Assignment-6 End User Based Usability testing = 10 pts
- Final Project / Term Paper (Group) = 42 pts (3 pts proposal, 39 pts final paper,
- Peer evaluation=2 pts
- Participation/Attendance (with mini quizzes) = 3 pts

Grading Scale

100-95	A
94-90	A-
89-85	B+
84-80	B
79-75	B-
74-70	C+
69-65	C
64-60	C-
59-55	D+
54-50	D

Readings for this week

- **week-1-1** Introduction to HCI
 - Dix et.al. (2004). Human Computer Interaction. Introduction. pp. 1-8
- **Week-1-2** Evolution of HCI (skim through)
 - Grudin, J. (2012). Introduction: A Moving Target: The Evolution of Human–Computer Interaction
- **week-1-3** HCI Research Themes and Trends of past 60 Years (read only Discussion section)
 - Fatih Gurcan, Nergiz Ercil Cagiltay & Kursat Cagiltay (2021)
- **week-1-4** Shneiderman - Ch-1 usability of interactive systems (skim through)
 - Shneiderman, B. et.al. (2016). Usability of interactive systems. pp. 25-54.

What is HCI? (ACMs defn)

- a discipline that is concerned with the **design**, **evaluation**, and **implementation** of interactive computing systems for human use and with the study of major phenomena surrounding them
 - Interaction
 - Task based
 - User cognition
 - Organizational/social impact
 - The nature and the process of design
 - The nature of use
 - Communication

Use and Context

U1 Social Organization and Work



U3 Human-Machine Fit and Adaptation

U2 Application Areas

Human

H1 Human Information Processing

H2 Language, Communication and Interaction

H3 Ergonomics

Computer

C2 Dialogue Techniques



C1 Input and Output Devices



C3 Dialogue Genre



C4 Computer Graphics



C5 Dialogue Architecture



D3 Evaluation Techniques

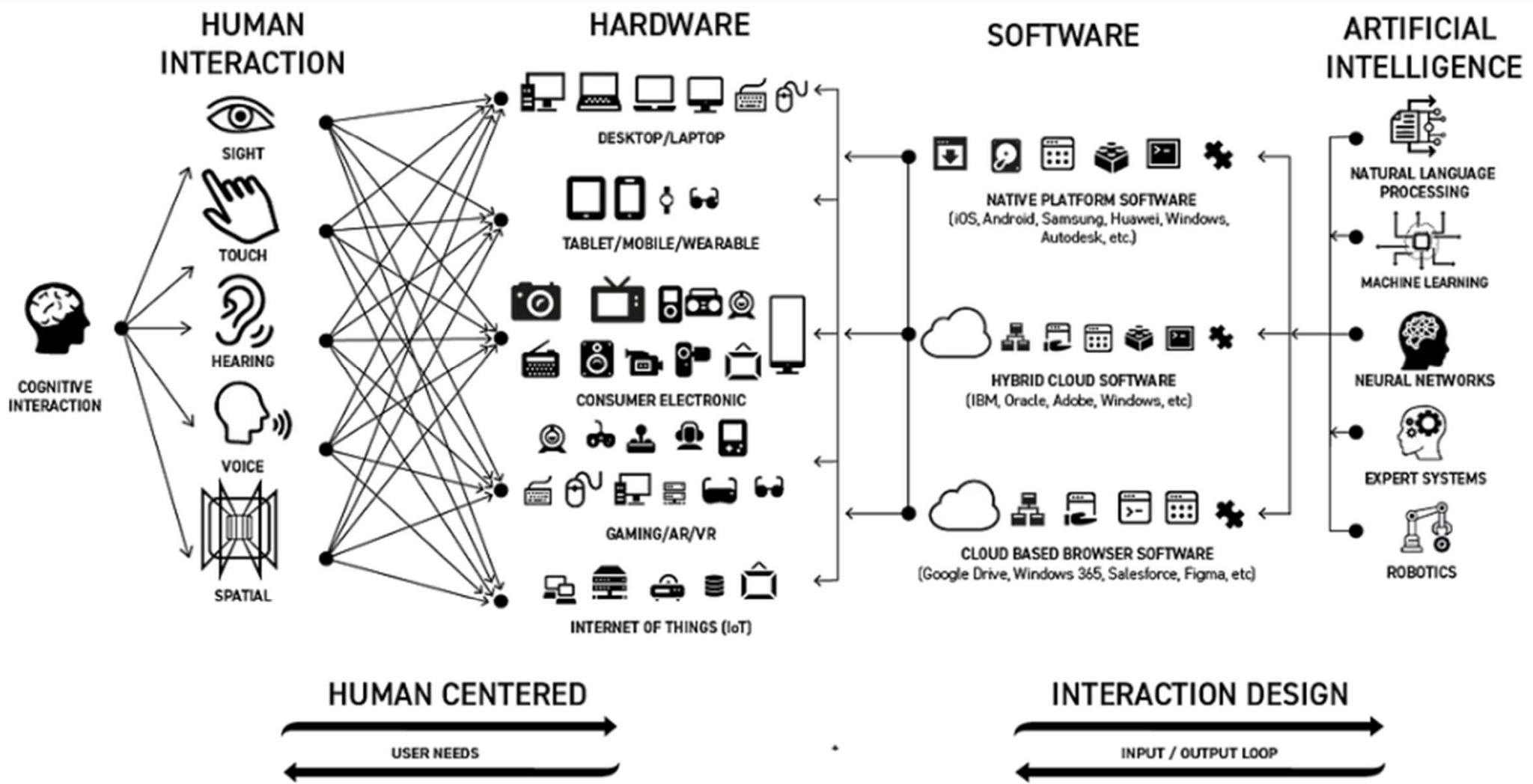
D4 Example Systems and Case Studies

D1 Design Approaches

D2 Implementation Techniques and Tools

Development Process

INTERACTION DESIGN PARADIGMS



Where do HCI People Work?

At Google, we follow a simple but vital premise: "Focus on the user and all else will follow." User Experience Researchers (UXRs) make this possible.



Senior UX Researcher, Google Cloud

Google

United States (Remote)

Senior UX Researcher, Google Cloud

Google · United States (Remote) 1 day ago · 10 applicants



\$152,000/yr - \$163,000/yr (LinkedIn est.) · Full-time · Mid-Senior level



10,001+ employees · Technology, Information and Internet



17 connections · 15 company alumni · 454 school alumni



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Principal UX Researcher
Microsoft
Washington, DC (Remote)

Principal UX Researcher

Microsoft · Washington, DC (Remote) 1 week ago · 42 applicants



Full-time · Associate



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AR/VR User Experience Researcher

Apple

Cupertino, CA

As a member of our organization, you will drive exploration of future products that will delight, inspire, and empower millions of people.

AR/VR User Experience Researcher

Apple · Cupertino, CA 1 week ago · Over 200 applicants

Full-time

10,001+ employees · Computers and Electronics Manufacturing

- Design, plan and conduct user research, employing methods such as usability studies, Information Architecture (IA) studies, field studies, competitive evaluations, heuristic evaluations, surveys, and other relevant approaches

ebebek  **Kullanıcı Deneyimi ve Tasarım Müdürü**
ebebek
Bostancı, İstanbul, Turkey (Hybrid)
 1 company alumnus works here

 **Senior User Experience Researcher**
Hepsiburada (NASDAQ: HEPS)
Istanbul, Turkey (Hybrid)

 **Senior User Experience Researcher**
Hepsiburada (NASDAQ: HEPS) · İstanbul, Turkey (Hybrid) 3 weeks ago · 90 applicants

 Full-time · Mid-Senior level

 1,001-5,000 employees · Technology, Information and Internet

 **User Experience Researcher**
n11
İstanbul, Turkey (Remote)
 Your profile matches this job
2 days ago ·  Easy Apply

*Technology
should be as
simple as the
box it comes in*
- PHILIPS

Easy to say,
Hard to Realize



**Technology should be as simple
as the box it comes in.**

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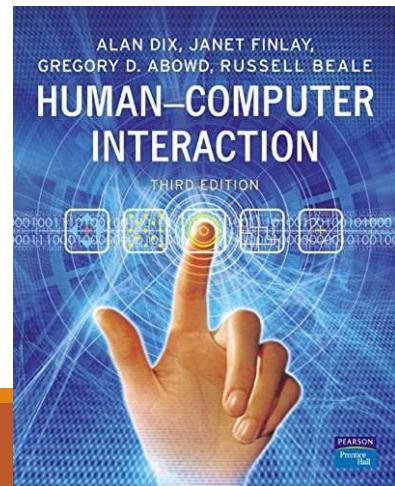
META CONNECT 2024

September 25-26

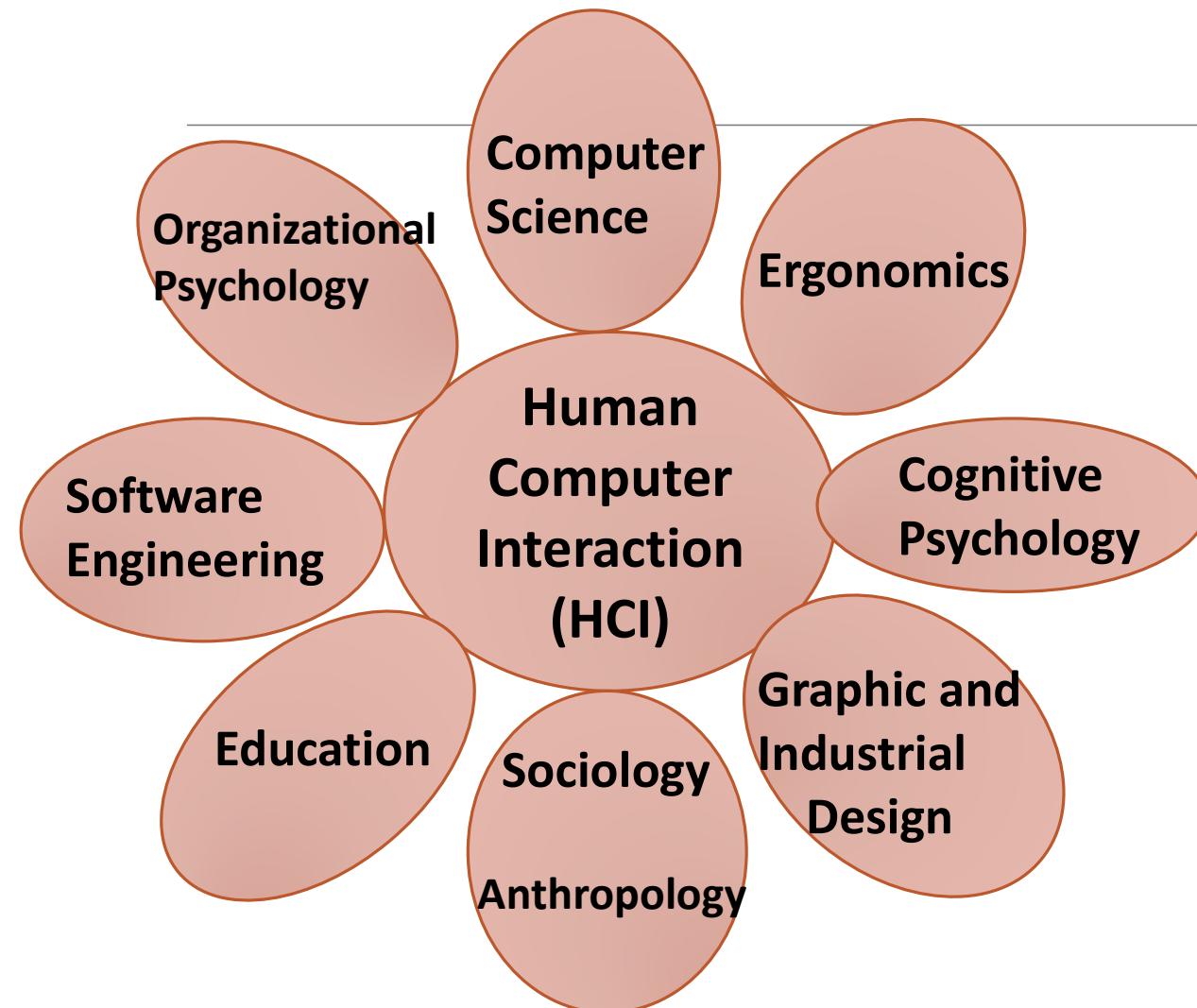


What is HCI? (Alan Dix – Reading-1)

- HCI involves the
 - design, implementation and evaluation of
 - interactive systems (direct or indirect)
 - in the context of
 - the user's (individual, group, sequence, ...)
 - task and work.



HCI is Inter/Transdisciplinary



Alan Dix's message for CS449/549



Be pragmatists rather than theorists

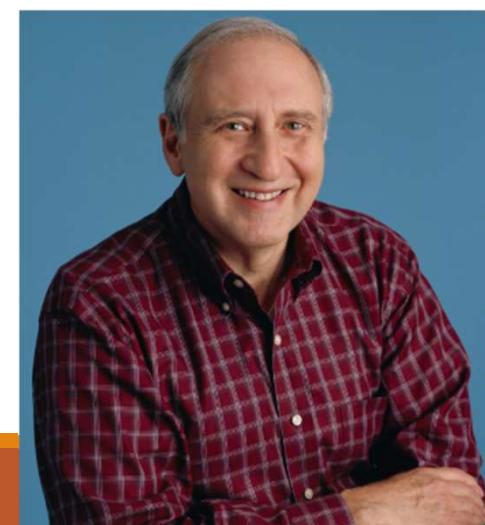
- We want to know how to apply the theory to the problem
- rather than just acquire a deep understanding of the theory.
- Be multi-disciplinary but practical.
- We concentrate particularly on computer science, psychology and cognitive science as core subjects, and on their application to design
- There is no general and unified theory of HCI



Usability of interactive systems:

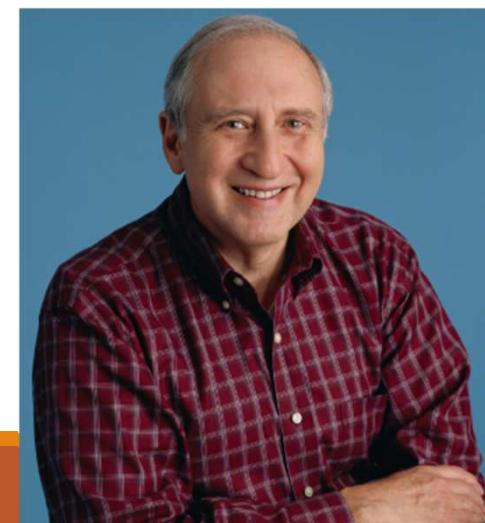
Ben Shneiderman. Reading-4

- Shneiderman is called as the father of HCI. University of Maryland Department of Computer Science
- interdisciplinary design science of human-computer interaction by applying the methods of experimental psychology to the powerful tools of computer science
- go beyond vague notions of “user friendliness,” “intuitive”
 - **study evidence-based guidelines**



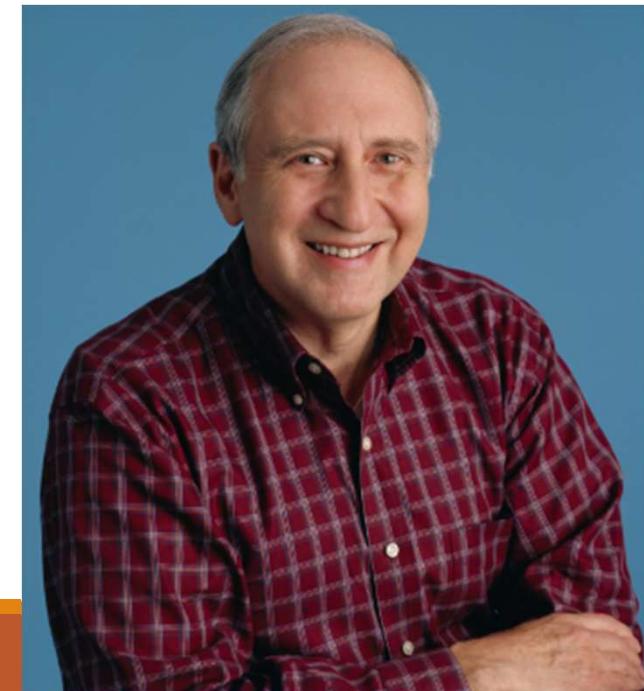
Usability of interactive systems: Ben Shneiderman. Reading-4 (for your 1st assignment)

- Interface almost disappears, enabling users to concentrate on their work, exploration, or pleasure.
- They are “in the flow”
- Usability Measures
 1. Time to learn
 2. Speed of performance
 3. Rate of errors by users
 4. Retention over time
 5. Subjective satisfaction



HCI for All

- HCI for life critical systems
- HCI for social systems
- HCI for commercial uses
- HCI for home entertainment
- HCI for creativity, art
- HCI for education
- HCI for elderly, disabled, children
- HCI for robots
-

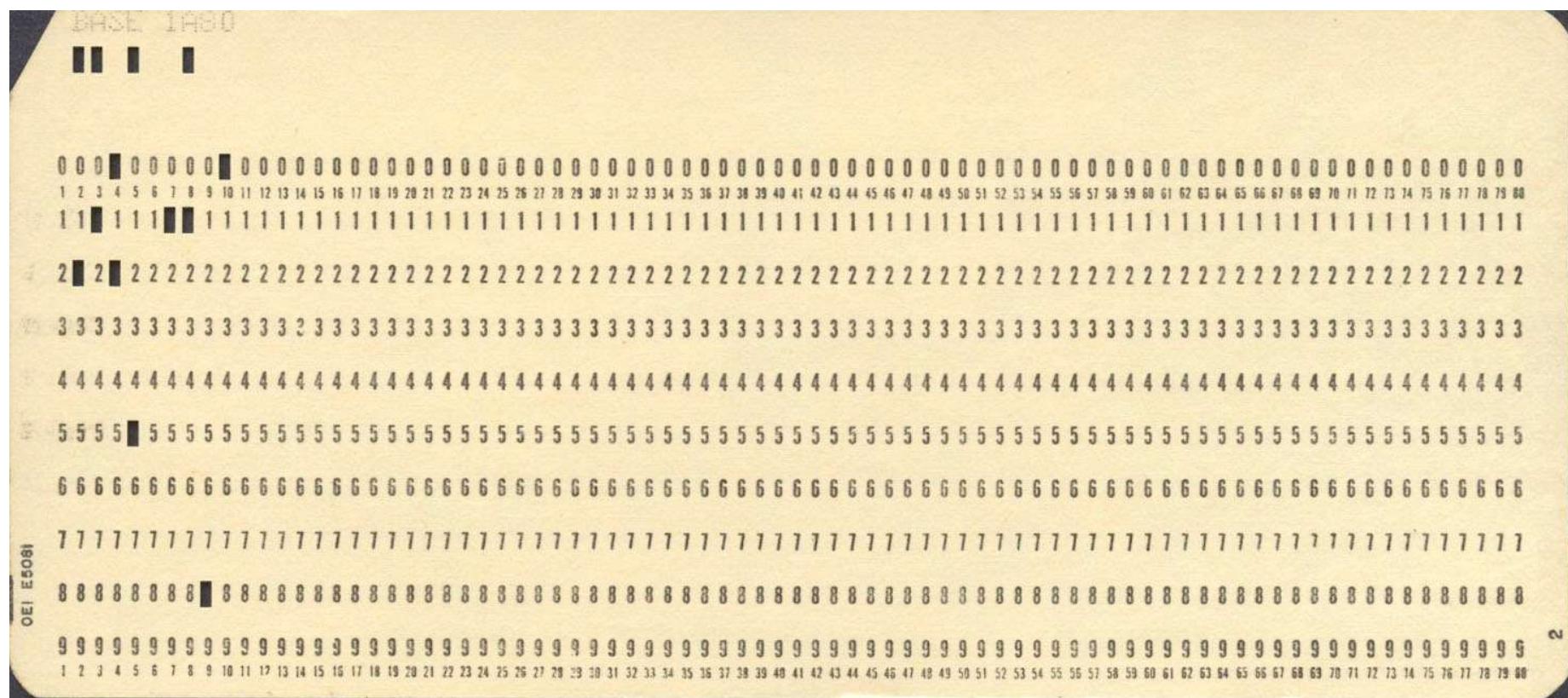


History

Grudin, J. Introduction: A Moving Target: The Evolution of Human–Computer Interaction



Interaction with Cartoons



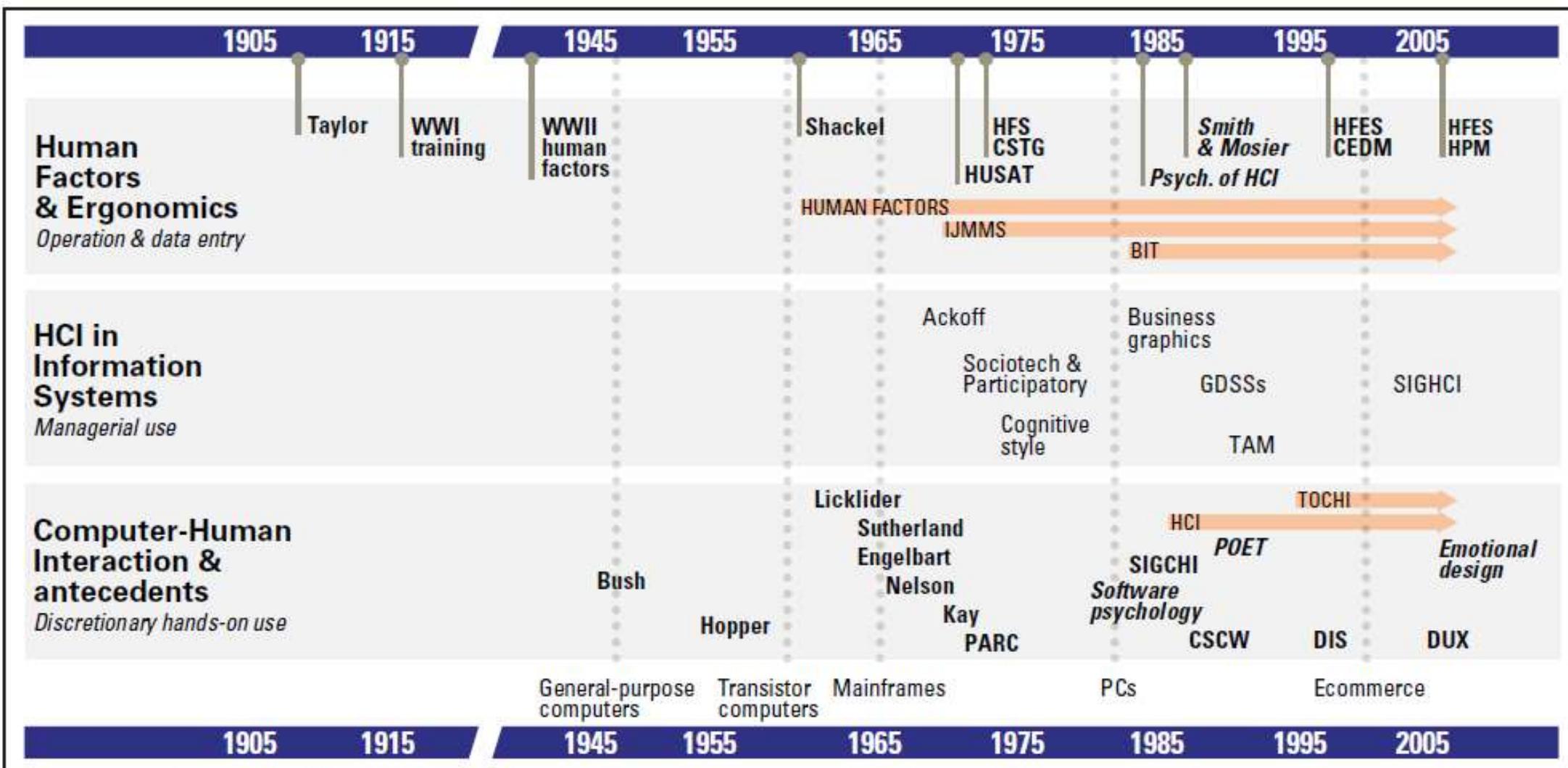


Figure 1. Three threads of HCI research and application

Historical Events- 1

1945

- Bush & MEMEX

1959

- Shackel, Ergonomics for a computer

1960

- Licklider, Man Computer Symbiosis

1965

- Engelbart, Mouse and Interaction

1969

- ARPANET - International Journal of Man Machine Studies

1970

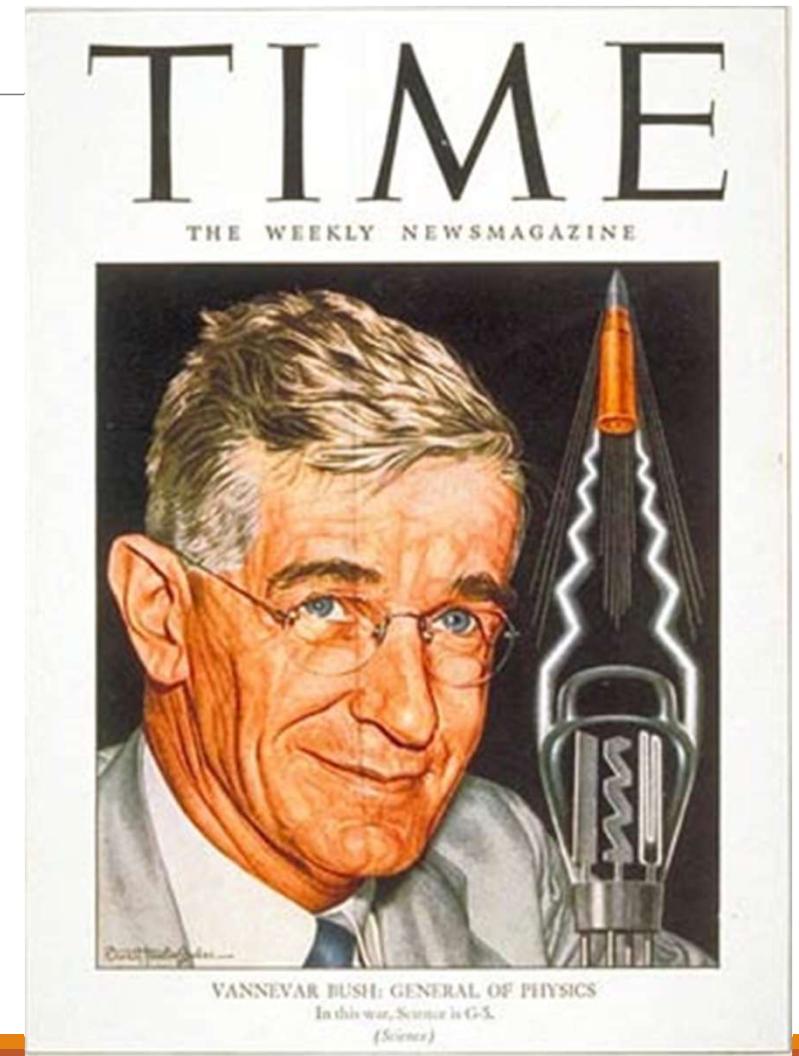
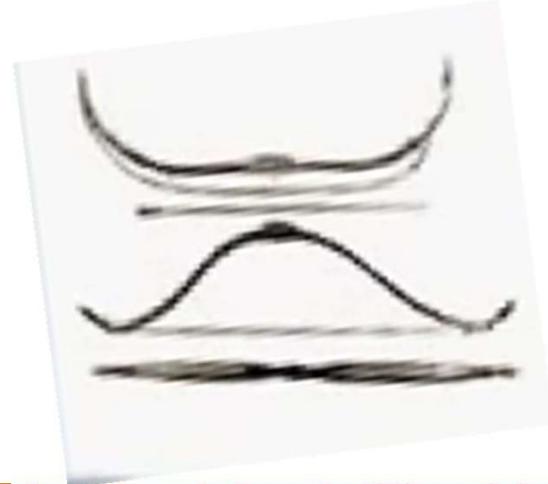
- England HUSAT, USA XEROX PARC

1971

- Weinberg, The Psychology of Computer Programming

As we may think – Memex (Bush 1945)

- Vannevar Bush, visionary article,
- PC, Internet, HCI
- First reference to Turks in IT literature
- «Memex is an enlarged intimate supplement to one's memory»



As we may think, The Atlantic Monthly, July 1945
<http://www.theatlantic.com/doc/194507/bush>

As we may think: MEMEX (July 1945)

- “Consider a future device ...
- in which an individual stores all his books, records, and communications, and which is mechanized so that
- it may be consulted with exceeding speed and flexibility.
- It is an enlarged intimate supplement to his memory.”



<http://www.theatlantic.com/doc/194507/bush>

Memex

Intergalactic Computer Network - 1963



- **Joseph Carl Robnett Licklider, MIT**
- "Man-Computer Symbiosis"
- Mutually-interdependent, "living together", tightly coupled human brains and computing machines would prove to complement each other's strength
- <https://www.kurzweilai.net/memorandum-for-members-and-affiliates-of-the-intergalactic-computer-network>

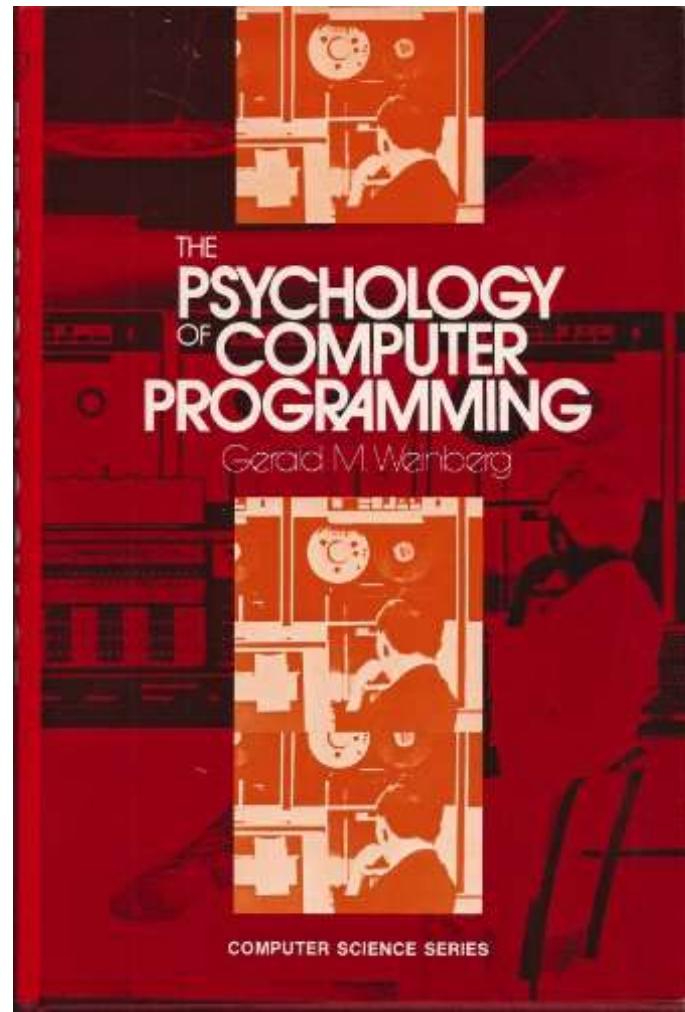


Licklider (1960)

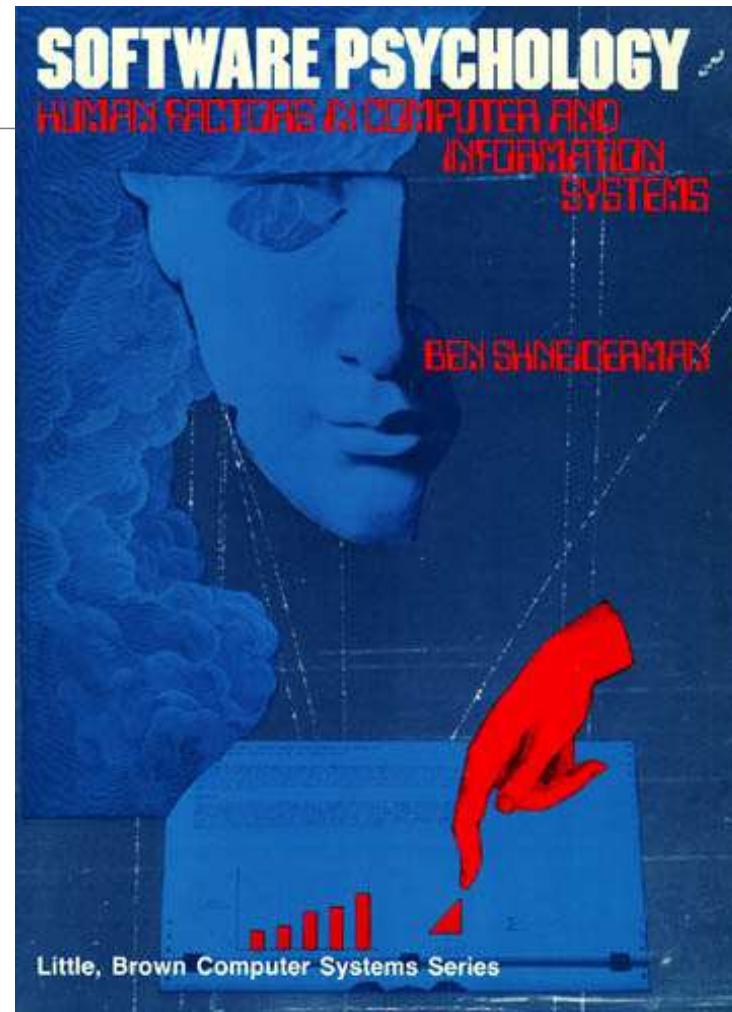
(The aim is) “to bring computing machines effectively into processes of thinking that must go on in ‘real-time’. To think in interaction with a computer in the same way that you think with a colleague whose competence supplements your own will require much tighter coupling between man and machine than is possible today”

<https://groups.csail.mit.edu/medg/people/psz/Licklider.html>

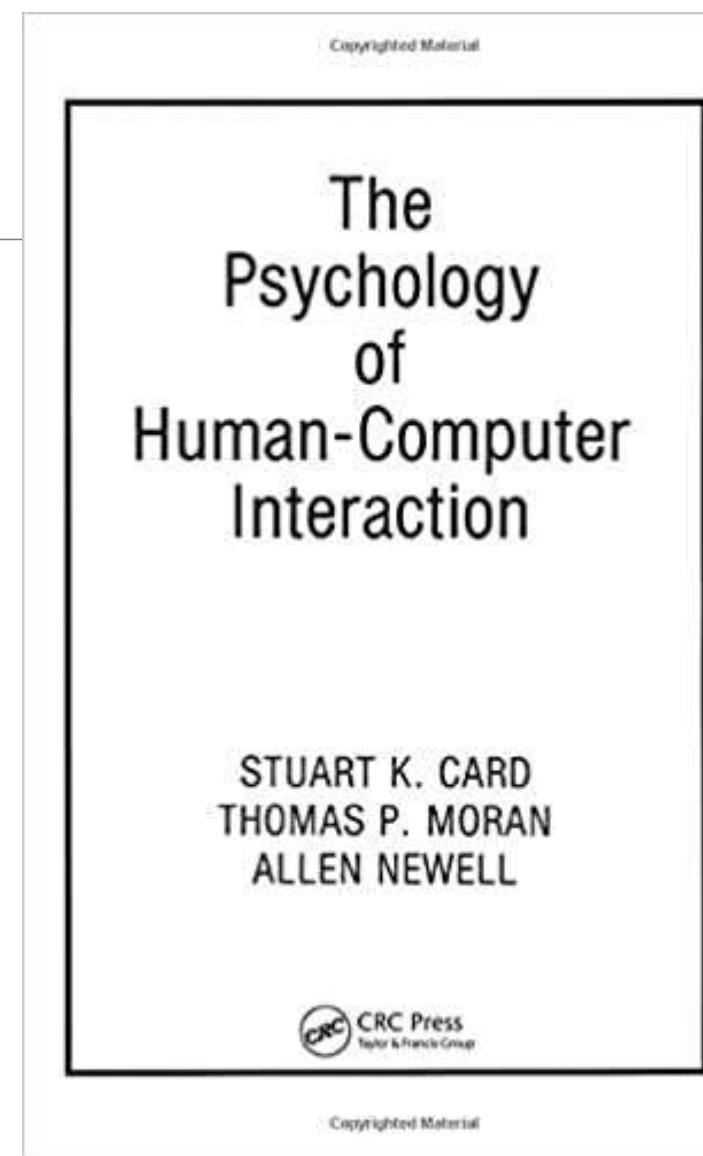
1971



1980



1986



Engelbart and the Dawn of Interactive Computing: SRI's 1968 Demo



Control Devices

- <https://www.youtube.com/watch?v=hRYnloqYKGY>

Historical Events- 2

1976	• NATO Workshop Human Computer Interaction
1970s	• Concept of «user friendliness» emerged
1980	• Shneiderman, Software Psychology
1982	• Behavior and Information Technology journal
1982	• ACM SIGCHI and CHI conferences
1985	• Hypertext systems
End of 1980's	• 4 new HCI journals, Usability labs • Mainframes to mini systems, PCs

Historical Events- 3

1990s

- Internet & WWW

Late
1990s

- Formal university HCI degree programs – e.g.CMU

2000

- mobile technologies
- Social networks
- VR and AR
- Wearable technologies
- Affective interaction

2015

- Brain Computer Interaction

Spatial Computing, Face Computing

TÜBİTAK Vision 2023 Report

- **1. Kullanımı eğitim gerektirmeyen bilgisayarların geliştirilmesi.**
- “İnsanlar bilgisayara ayak uyduracağına, bilgisayarlar insanlara ayak uydurmmalı; bir başka deyişle, “insan okur-yazarlığı” olan bilgisayarlar yapılmalı”. (Sayfa 73)

- **1. Development of computers that do not require training to use**
- Instead of humans keeping up with computers, computers must keep up with humans; in other words, computers with “human literacy” should be built

- http://vizyon2023.tubitak.gov.tr/Strateji_Belgesi-V211.pdf

Research themes and trends (Reading-3)



International Journal of Human-Computer Interaction

ISSN: (Print) (Online) Journal homepage: <https://www.tandfonline.com/loi/hihc20>

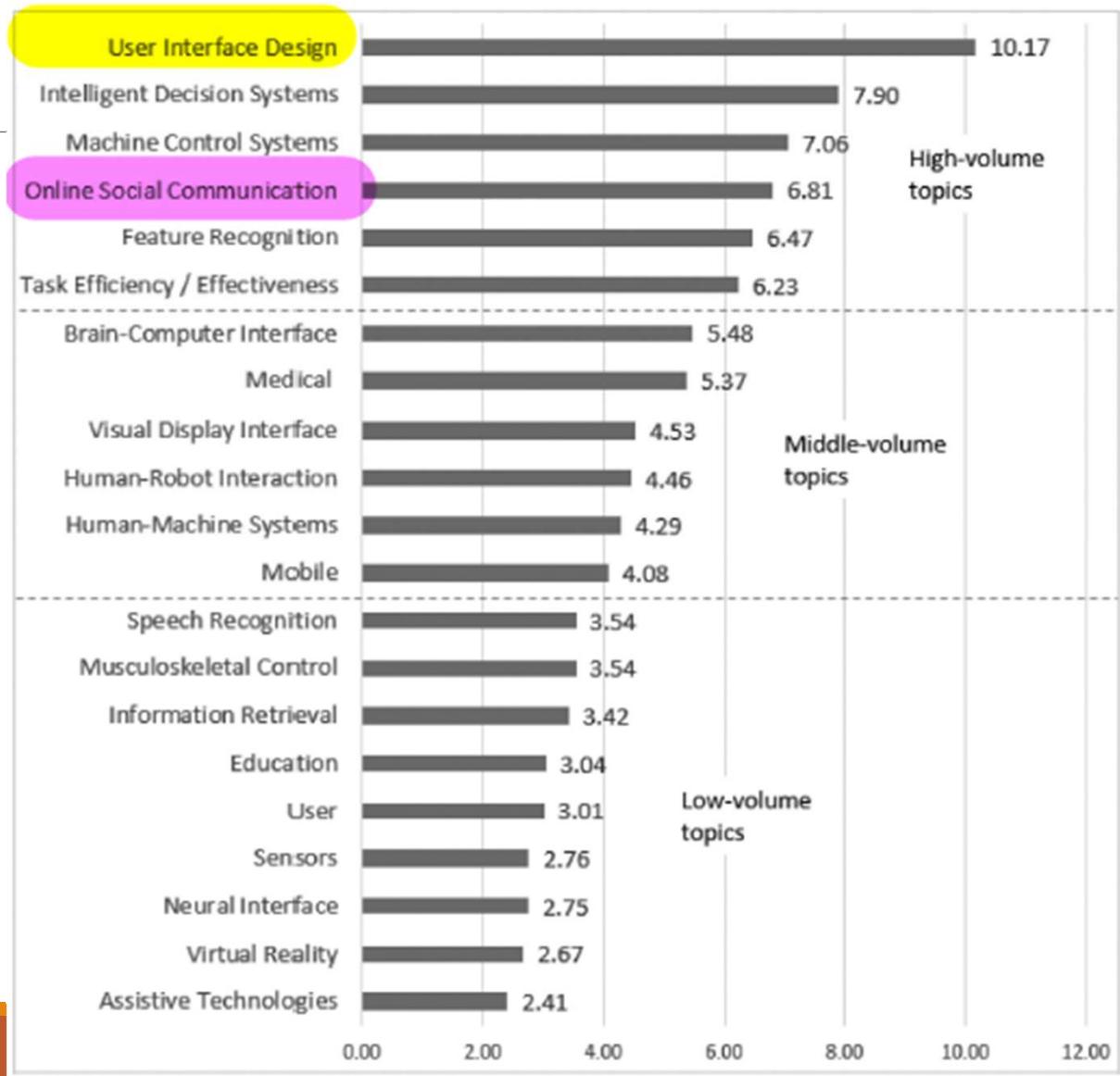
Mapping Human-Computer Interaction Research Themes and Trends from Its Existence to Today: A Topic Modeling-Based Review of past 60 Years

Fatih Gurcan, Nergiz Ercil Cagiltay & Kursat Cagiltay

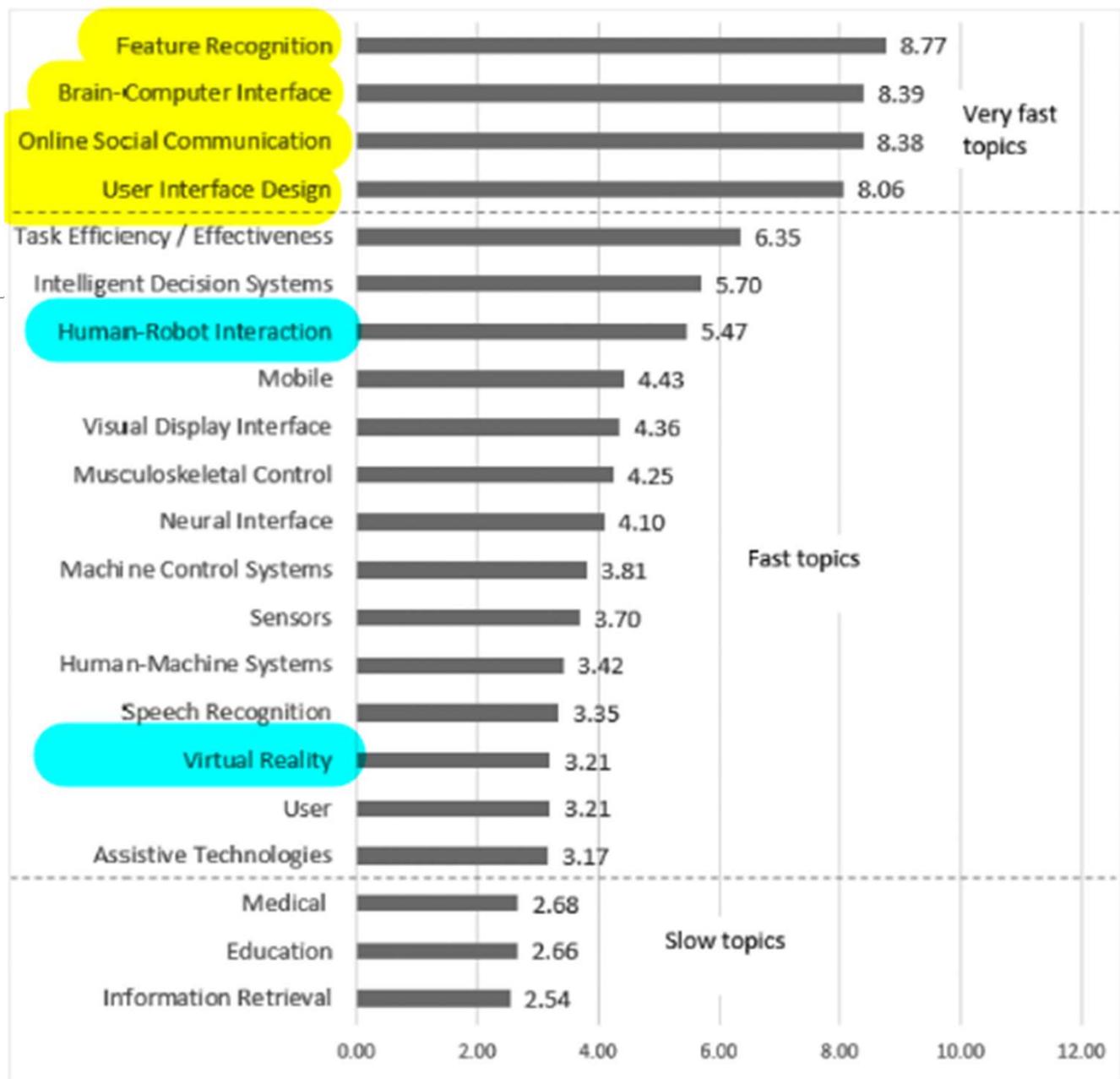
Topic Trends by Decades

Decade	Top Five Highest Mean Topics
1959–1968	Human-Machine Systems, Machine Control Systems, Task Efficiency/Effectiveness, Intelligent Decision Systems, User Interface Design
1969–1978	Machine Control Systems, Intelligent Decision Systems, Human-Machine Systems, Task Efficiency/Effectiveness, User Interface Design
1979–1988	Machine Control Systems, Intelligent Decision Systems, User Interface Design, Human-Machine Systems, Task Efficiency/Effectiveness
1989–1998	User Interface Design, Machine Control Systems, Intelligent Decision Systems, Medical, Task Efficiency/Effectiveness
1999–2008	User Interface Design, Medical, Intelligent Decision Systems, Machine Control Systems, Online Social Communication
2009–2018	Feature Recognition, Brain-Computer Interface, Online Social Communication, User Interface Design, Task Efficiency/Effectiveness

Number of Publications



Speed of Topics



Result

- 41,720 HCI related journal articles between 1957 and 2018
- transition of HCI studies from machine-oriented systems to
 - human-oriented systems indicates its future direction toward
 - context-aware adaptive systems

New interfaces

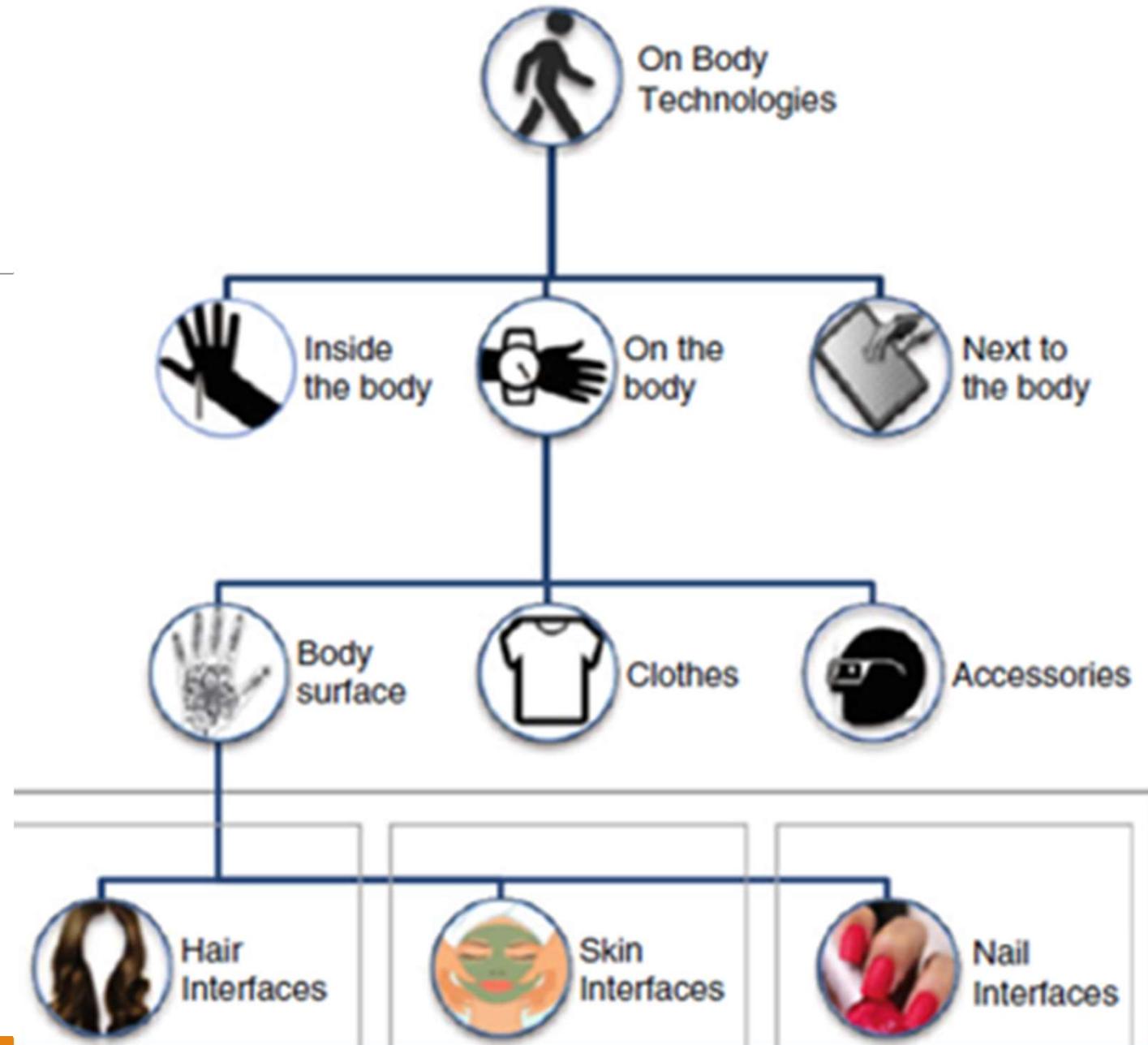
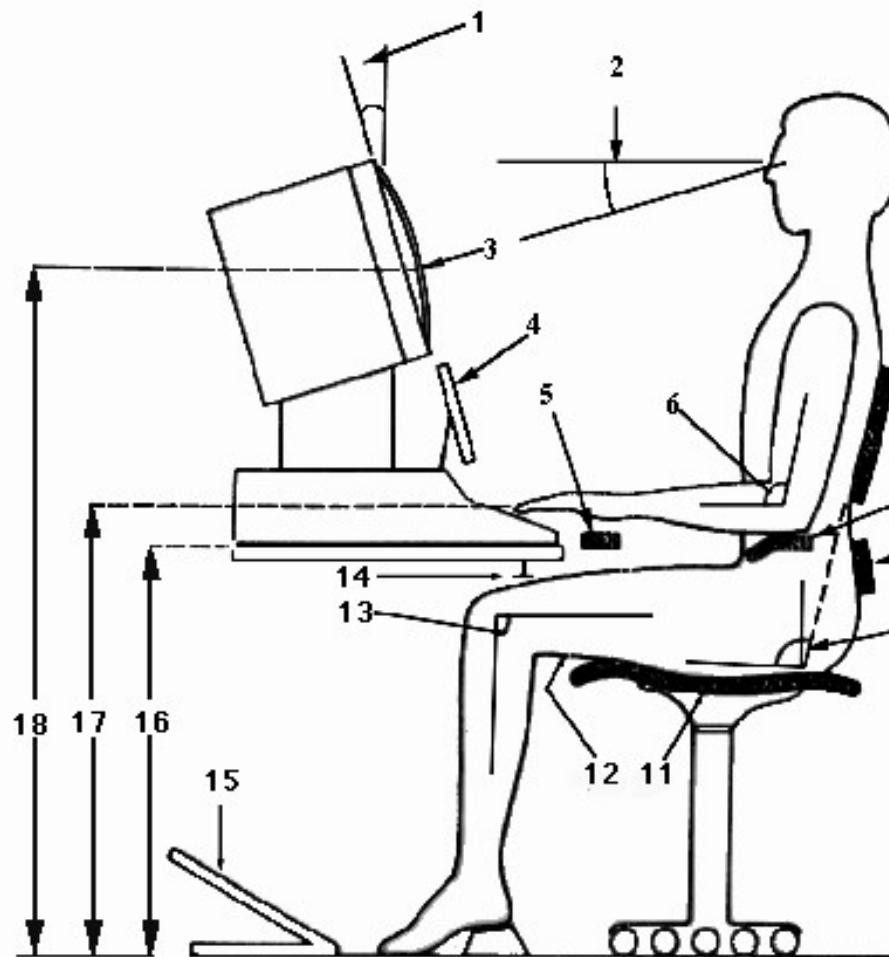




Fig. 4.12 Winkymote usage. (a) placing sensors on skin, (b) connecting the remote control. (c) first time Felipe turn on the TV by himself after 13 years. Image reproduced with permission from Felipe Esteves

Physical Interaction?



1. Screen tilt angle
2. Visual angle between the horizontal and the center of the display
3. Eye-screen distance
4. Document holder and source document
5. Wrist rest
6. Elbow angle
7. Backrest
8. Elbow rest
9. Lumbar support
10. Seat back angle (from horizontal)
11. Seat pan angle (from horizontal)
12. Clearance between leg and seat
13. Knee angle
14. Clearance between leg and table
15. Footrest
16. Table height
17. Home row (middle row height)
18. Screen height to center of screen

Week-2 Readings (for the 1st assignment)



Week-2 Shneiderman-ch3 Guidelines Principles and Theories

Shneiderman, B. et.al. (2016). Guidelines, Principles and Theories. pp. 81-120. Designing the User Interface: Strategies for Effective Human-Computer Interaction, 6th Edition



Week-2 Norman - Design of everyday things Ch2

Norman, D. (2013). The psychology of everyday actions, Ch.2 pp. 37-122. The design of everyday things. Basic Books.



Week-2 Landauer_Trouble_with_computers Ch4 (Skim Through)

Landauer (1995) Excuses, Ch4, pp. 83-113. Trouble with computers: Usefulness, Usability, and Productivity. MIT Press